CATALOG DOCUMENTATION
NATIONAL LAKE ASSESSMENT DATABASE
NORTHEAST REGION 2007
PREDICTED LAKE DEPTH AND VOLUME

TABLE OF CONTENTS

1. DATASET IDENTIFICATION
1.1 Title of Catalog document
 National Lake Assessment (NLA) Database
 Northeast Region 2007
 Predicted Lake Depth and Volume

1.2 Author of the Catalog entry
 Melissa Hughes, Raytheon MOS

1.3 Catalog revision date
 July 2011

1.4 Dataset name
 Predicted Lake Depth and Volume

1.5 Task Group
 National Lake Assessment

1.6 Dataset identification code
 NA

1.7 Version
 NA

1.8 Request for Acknowledgment
 EPA requests that all individuals who download National Lake Assessment data
 acknowledge the source of these data in any reports, papers, or presentations.
 If you publish these data, please include a statement similar to: "Some or all
 of the data described in this article were produced by the U. S. Environmental
 Protection Agency through its National Lake Assessment (NLA) Program".

2. INVESTIGATOR INFORMATION
2.1 Principal Investigators
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2.2 Sample Collection Investigators
 NA

2.3 Sample Processing Investigators
 NA

3. DATASET ABSTRACT
 3.1 Abstract of the Dataset
 Lake volume aids understanding of the physical and ecological dynamics of
 lakes, yet is often not readily available. The data needed to calculate lake
 volume (i.e. bathymetry) are usually collected on a lake by lake basis and are
 difficult to obtain across broad regions. To span the gap between studies of
 individual lakes where detailed data exist and regional studies where access
 to useful data on lake volume is unavailable, a method was developed to
 predict maximum lake depth from the slope of the topography surrounding a lake
 and to use these predictions to estimate lake volume. The National Elevation
 Dataset and the National Hydrography Dataset-Plus was used to estimate the
 percent slope of surrounding lakes and this information was used to predict
 maximum lake depth and estimate lake volume. Field measured maximum lake
 depths were also used from the US EPA's National Lakes Assessment to
 empirically adjust the predictions. The final predictions were tested with
 maximum lake depth data from on-line sources. Maximum depth was predicted for
 ~28,000 lakes in the Northeastern United States with an average percent
 difference of 4%.

 3.2 Keywords for the Dataset
 lake bathymetry, lake morphology, National Lakes Assessment, lake volume,
 geographic information systems (GIS), NHD Plus, Lakes Ecosystem Services

4. OBJECTIVES AND INTRODUCTION
 4.1 Program Objective
 The U.S. Environmental Protection Agency (EPA), in partnership with state and
 tribal organizations, has designed the Survey of the Nation's Lakes to
 periodically assess the condition of the Nation's surface waters. The
 National Lake Assessment is a statistical assessment of the condition of
 our Nation's lakes, ponds, and reservoirs and is designed to: 1) Assess the
 condition of the Nation's Lakes; 2) Establish a baseline to compare future
 surveys for trends assessment and evaluate trends since the 1970's National
 Eutrophication Survey Study and 3) Help build State and Tribal capacity for
 monitoring and assessment and promote collaboration across jurisdictional
 boundaries. This survey will generate a statistically-valid report on the
 condition of our Nation's water resources and identify key stressors to this
 system. The goal of the Nation's Lakes project is to address two key questions
 about the quality of the Nation's lakes, ponds, and reservoirs: 1) What
 percent of the Nation's lakes are in good, fair, and poor condition for key
 indicators of trophic state, ecological health, and recreation? and 2) What is
 the relative importance of key stressors such as nutrients and pathogens?

 The Survey is designed to be completed during the summer growing season before
 lake turnover (June through September). Field crews will collect a variety of
 measurements and indicators from an "index site" located at the deepest point
 of the lake (≤50 meters, and near the center if sampling a reservoir), and
 document conditions of the littoral zone and shoreline from stations around
 the lake.

 EPA selected sampling locations using a probability based survey design.
 Sample Surveys have been used to determine the status of a population or

resources of interest using a representative sample of a relatively few members or sites. Using this survey design allows data from the subset of sampled lakes to be applied to the larger target population and assessments with known confidence bounds to be made.

4.2 Dataset Objective
The objective of the Predicted Lake Depth and Volume data is to present depths and volumes for NLA lakes which can be utilized with sufficient accuracy for regional scale studies of nutrient cycling and ecosystem services.

4.3 Dataset Background Discussion
The data set contains data derived from measurements collected in 2007 from Northeast region lakes from the states of Maine to West Virginia.

The importance of lake morphometry (e.g. lake depth and lake volume) in understanding the ecology of lake systems has long been recognized. Scientists and managers use this information to describe a lake's residence time, build predictive models of nutrients, pollutants, and ecological populations, and to understand lake productivity. For individual lakes that are the focus of research and management, bathymetry surveys are some of the first data collected. From these data, volume is usually calculated using bathymetric contour maps and planimeters. Lake volume can also be estimated with modern GIS methods if maximum depth is known. Calculating depth and volume of lakes is a simple task provided bathymetry surveys exist; however, gaining access to these data is often difficult as they are frequently only available as unpublished tables or paper maps. This is especially true in regional studies that include a large number of lakes. As part of the US Environmental Protection Agency's Lakes Ecosystem Services program (LES), how changes in nutrient loads impact the delivery of ecosystem services in lakes in the Northeastern Region of the United States is being evaluated. Obtaining bathymetry data for even a small percentage of the lakes within this region can be difficult and modelling lake depth and volume using existing, publically available datasets was conducted. One key source of information that provides insight into lake depth is the National Elevation Dataset (NED). With this information it is possible to calculate changes in elevation surrounding lakes, which is likely similar to the change in depth within lakes as the same processes formed the surrounding topography and the lake basin. Thus, the assumption is made that lake basins surrounded by steep topography are likely to have a steeper slope and greater changes in depth than do lake basins with lower topographic relief. This dataset contains an estimated maximum lake depth for all National Hydrography Dataset Plus (NHDPlus) lake polygons in the Northeast US (USGS Major River Basin 1) with sufficient accuracy for regional scale studies of nutrient cycling and ecosystem services. These estimates of lake depth are used to estimate lake volume.

4.4 Summary of Dataset Parameters
Predicted lake depth and volume data are reported.

5. DATA ACQUISITION AND PROCESSING METHODS
5.1 Data Acquisition
The sample collection methods used by USEPA NLA trained field crews will be described here.

5.1.1 Sampling Objective
 Find the deepest point in the lake using sonar.

5.1.2 Sample Collection: Methods Summary
To find the location of the index site for natural lakes, find the
deepest point in the lake ≤50 meters by using sonar and/or a
bathymetric map and by observing the lake shape and surrounding
topography.

5.1.3 Beginning Sampling Dates
5/8/2007

5.1.4 Ending Sampling Dates
10/18/2007

5.1.5 Sampling Platform
Samples were collected from gasoline or diesel powered boats.

5.1.6 Sampling Equipment
Hand-held sonar unit, a calibrated sounding line, or a calibrated pole for
very shallow lakes

5.1.7 Manufacturer of Sampling Equipment
Not applicable

5.1.8 Key Variables
Not applicable

5.1.9 Sample Collection: Calibration
NA

5.1.10 Sample Collection: Quality Control
NA

5.1.11 Sample Collection: References
USEPA. 2007. Survey of the Nation's Lakes. Field Operations Manual.
EPA 841-B-07-004. US Environmental Protection Agency, Washington, DC.
(http://water.epa.gov/type/lakes/lakessurvey_index.cfm#CP_JUMP_474534)

5.1.12 Sample Collection: Alternate Methods
NA

5.2 Data Preparation and Sample Processing
Physical data did not require analytical processing.

5.2.1 Sample Processing Objective
NA

5.2.2 Sample Processing: Methods Summary
NA

5.2.3 Sample Processing: Calibration
NA

5.2.4 Sample Processing: Quality Control
NA

5.2.5 Sample Processing: References
NA

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   5.2.6 Sample Processing: Alternate Methods
    Not Applicable


6.  DATA ANALYSIS AND MANIPULATIONS
 6.1 Name of New or Modified Value
  PREDICTED_DEPTH_M, PREDICTED_VOLUME_M3


 6.2 Data Manipulation Description
  Methods were developed with elevation and lake data from Major River Basin 1
  (MRB1) which correspond to NHD HUC regions 01 and 02.  Depth predictions were
  generated using lake shoreline data from the NHDPlus, reach catchments from
  NHDPlus, and elevation from the NED.  For this study, the 10 meter resolution
  NED (Data available from U.S. Geological Survey at http://ned.usgs.gov) was
  used and resampled that data to a 30 meter resolution. Additionally, existing
  sources of field collected lake depth data were used to test some key
  assumptions, and correct and assess the accuracy of the depth predictions.
  Maximum lake depth measurements from the USEPAs National Lake Assessment (NLA)
  were used to adjust the initial depth predictions. Predictions of maximum
  depth were assessed by comparison with maximum depth values for Northeastern
  lakes collected from internet sources.  All data used in this study use the
  North American 1983 datum and are in an Albers Equal Area Conic projection.


7. DATA DESCRIPTION
 7.1 Description of Parameters
  7.1.1 Components of the Dataset
  Attribute Name          Format          Description
  -------------------------------------------------------------------------
  WB_ID                   NUMBER(10)      Unique Waterbody ID
  NLA_ID                  VARCHAR2(60 BYTE) National Lake Assessment study
                                          unique ID for each lake
  EPA_REGION              VARCHAR2(50 BYTE) EPA Region
  STATE                   VARCHAR2(50 BYTE) State name
  LATITUDE_DD             NUMBER(12,6)    Field Calculator in ARC GIS used to
                                          calculate latitude (decimal degrees)
                                          values for point features.
  LONGITUDE_DD            NUMBER(12,6)    Field Calculator in ARC GIS used to
                                          calculate longitude (decimal
                                          degrees values for point features.
  PREDICTED_DEPTH_M       NUMBER(11,8)    Predicted Depth (m)
  PREDICTED_VOLUME_M3     NUMBER(9,3)     Predicted Volume (m3)
  -------------------------------------------------------------------------


  7.1.2 Precision of Reported Values
   NA


  7.1.3 Minimum Value in Dataset / 7.1.4 Maximum Value in Dataset
   PARAMETER              MIN             MAX
   LONGITUDE_DD          -80.208767     -66.99852
   LATITUDE _DD           36.702015      47.416054
   PREDICTED_DEPTH_M      0.0            82.81831685
   PREDICTED_VOLUME_M3    0.0            3502058720


 7.2 Data Record Example
  7.2.1 Column Names for Example Records
   WB_ID,NLA_ID,STATE,COUNTY,EPA_REGION,LONGITUDE_DD,LATITUDE_DD,
   LAKE_NAME,PREDICTED_DEPTH_M,PREDICTED_VOLUME_M3
```

```
   7.2.2 Example Data Records
    1701064,NLA06608-1110,Maine,Piscataquis,Region_1,-69.22944,45.81763,
    Little Kelly Pond,1,50507
    1701184,NLA06608-NELP-3586,Maine,Piscataquis,Region_1,-69.07735,45.75283,
    Fourth Debsconeag Lake,20,6593353
    1701190,NLA06608-EMAP:ME011L,Maine,Piscataquis,Region_1,-69.22256,45.74832,
    Female Pond,7,1203681
```

8. GEOGRAPHIC AND SPATIAL INFORMATION
 8.1 Minimum Longitude (Westernmost)
  -80.208767 decimal degrees

 8.2 Maximum Longitude (Easternmost)
  -66.99852 decimal degrees

 8.3 Minimum Latitude (Southernmost)
  36.702015 decimal degrees

 8.4 Maximum Latitude (Northernmost)
  47.416054 decimal degrees

 8.5 Name of area or region
  The National Lake Assessment Northeast Region covers the northeastern US
  from Maine to West Virginia.

9. QUALITY CONTROL AND QUALITY ASSURANCE
 9.1 Measurement Quality Objectives
  NA

 9.2 Data Quality Assurance Procedures
  NA

 9.3 Actual Measurement Quality
  NA

10. DATA ACCESS
 10.1 Data Access Procedures
  Access data at: http://www.epa.gov/aed/lakesecoservices by clicking on the
  Database link.

 10.2 Data Access Restrictions
   None

 10.3 Data Access Contact Persons
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 10.4 Dataset Format
   Comma-delimited ASCII files

 10.5 Information Concerning Anonymous FTP
   Not available

10.6 Information Concerning WWW
  See Section 10.1 for WWW access

10.7 EMAP CD-ROM Containing the Dataset
  Data not available on CD-ROM

11. REFERENCES

J. W. Hollister, Milstead, B.W. and Urrutia, A.M. In press. Predicting Maximum
Lake Depth and Estimating Lake Volume from Surrounding Topography.

USEPA. 2007. Survey of the Nation's Lakes. Field Operations Manual.
EPA 841-B-07-004. US Environmental Protection Agency, Washington, DC.
(http://water.epa.gov/type/lakes/lakessurvey_index.cfm#CP_JUMP_474534)

USEPA. 2009. Survey of the Nation's Lakes: Integrated Quality Assurance
Project Plan. EPA/841-B-07-003. US Environmental Protection Agency,
Washington, DC. (http://water.epa.gov/type/lakes/lakessurvey_index.cfm#CP_JUMP_474534)

USEPA. 2006. Survey of the Nation's Lakes. Lake Evaluation Guidelines.
EPA 841-B-06-003. US Environmental Protection Agency, Washington, DC.

12. TABLE OF ACRONYMS
  EPA   Environmental Protection Agency
  NLA   National Lakes Assessment
  QA/QC Quality Assurance/Quality Control
  WWW   World Wide Web

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